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GLOBAL WARMING, CLIMATE CHANGE AND HUMAN PSYCHOLOGY

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Abstract. This chapter considers psychological aspects of global warming and climate change. It begins with a brief consideration of the public and political recognition of global warming and climate change as significant environmental issues. The chapter then turns to a review of the scientific evidence of the causes and consequences of climate change, and some of the issues in psychology that attend its investigation. The main section of the chapter reviews characteristics of global warming and climate change that function as psychological barriers for the awareness of their existence and for willingness to act. Using Construal Level Theory, a new integrative approach is then outlined that links climate change barriers with psychological distance, and implications of the high-level construals of climate change are discussed. Thereafter some research agendas for further psychological research addressing global warming and climate change is proposed and delineated. This is followed by a section highlighting that the rate and consequences of global warming and climate change can be downgraded by global and local reductions of greenhouse gas emissions. The chapter finishes with some concluding remarks.

Keywords: global warming, climate change, psychology, barriers, climate change construals

Introduction

Discussion of issues related to global warming and climate change are increasingly frequent in public discourse. The last few years have seen the release of several movies dealing with the topic, including *An Inconvenient Truth*, *The 11th Hour*, *The Great Global Warming Swindle*, *The Day After Tomorrow* and *The Age of Stupid*. Media coverage has also appeared in popular magazines, including a special report on *Time* magazine (April 3, 2006) under the banner "*Global warming: Be worried. Be* very *worried*." An increasing number of scientific publications have also been dealing with the topic. The large and increasing number of scientific studies have been routinely assessed, and the main conclusions are summarised, in the reports by the Intergovernmental Panel on Climate Change (IPCC; discussed below). There is also an increasing number of psychological studies dealing with the topic (e.g., Gifford, 2008a; Heath & Gifford, 2006; Nilsson, von Borgstede, & Biel, 2004; Pawlik, 1991; Sundblad, Biel, & Gärling, 2009). The majority of lay people also seem to be aware of the problem. The results of a Gallup survey in the early 90s with representative samples from six nations (Brazil, Canada, Mexico, Portugal, Russia and USA) shows that the majority of lay persons in four of the six nations rated "global warming or the 'greenhouse' effect" as a very serious problem (Dunlap, 1998). Similarly, a more recent public opinion survey from Yale University also showed that 71% of the American public is convinced that global warming is happening (Leiserowitz, 2007).

Concern about climate change and the emission level of greenhouse gases is also evident in political discourse. For example, in a 2007 speech UN Secretary General Ban Ki-moon has warned that climate change poses as much of a danger to the world as war, and in a 2004 speech the former Prime Minister Tony Blair called climate change the world's greatest environmental challenge in a foreword to a book published in 2005 ("*Avoiding Dangerous Climate Change*").[1] As a result, global warming and climate change are a concern in many nations (see also Brouwer, Akter, Brander, & Haque, 2007; Harré & Atkinson, 2007), and they are seen as one of the most significant environmental issues in recent years (Heath & Gifford, 2006), or even the greatest challenge to our civilization (Triandis, 2008). However, despite the increasing certainty about the evidence for anthropogenic climate change (i.e., climate change caused by human activities), public opinion and political change has been very slow (or even non existent). This raises the question of "why"? Why do we not seem to be worried? This chapter tackles this question by specifically focusing on characteristics of global warming and climate change that function as psychological barriers for the awareness of their existence and for willingness to act.

In the first section, I will give a brief overview of the evidence for global warming and climate change. It will be argued that global warming and climate change are happening, that they are anthropogenic issues, and that their effects pose real threats for human living conditions and ecosystems. In the second section, I will present psychological barriers that allow us to understand human failure to become aware of global environmental changes and to act properly to address these changes. These barriers will be illustrated with data from my ongoing programme of research as well as from other published data. The third section briefly outlines a new integrative approach for understanding the climate change barriers based on Construal Level

[1] Political discourse is an unfortunate measure of what people feel because politicians would not address global warming and climate change if they did not think they would have the support of a sufficiently large fraction of their voters.

Theory (Trope & Liberman, 2003). This approach holds that climate change is a psychologically distant event, and for that reason people mentally construe climate change in terms of high-level, abstract, and stable characteristics. In the fourth section, I discuss research agendas through which the psychological barriers can be reduced, eliminated or overcome. Four interrelated psychological research areas that deserve special attention in dealing with global warming and climate change are discussed. In the forth section, I will highlight the challenges of change. This section briefly outlines the importance of both individual and community actions for tackling global warming and climate change. Some conclusions are presented in the fifth and last section of the chapter.

Facts about global warming and climate change: It is a happening thing!

The notion of global warming and climate change can be briefly summarised as follows. Some gases present in the Earth's atmosphere act like the covering of a greenhouse, allowing the sun's energy to enter but then keeping the heat from escaping back into space, thus helping to make our planet a warm and habitable place. Although greenhouses gases (e.g., carbon dioxide, methane and nitrous oxide) are emitted naturally from trees and animals, they are also emitted from human activities like burning coal, driving cars, farming and deforestation. An increase in such human activities leads to higher emissions of the greenhouse gases into the atmosphere and increases their concentrations. Rising concentrations of greenhouse gases in the atmosphere means that even more heat is being trapped from the sun, causing the planet to warm up and our natural weather patterns to change. *Global warming* refers to this process. However, it is preferable to think of *climate change* because the changes currently observed and predicted are not limited to temperature alone but also embrace changes in climate patterns and related events (sea rise, floods, cyclones, droughts and landslips) (Ministry for the Environment, 2007).

Although global warming and climate change are currently a *hot topic* (double meaning intended), a historical overview clearly shows that these are not new issues (see Table 1). It is true that evidence has increased since the late 1980s (Flavin & Engelman, 2009), but scientists have long indicated that human activities could cause large-scale changes in climate. Nowadays most of the widely disseminated scientific evidence relating to global warming and climate change comes from the assessment reports produced by the IPCC. The IPCC was established in 1988 by the World Meteorological Organization and the United Nations Environment Programme, and is open to 192 countries that are members of these organizations. The IPCC regularly assesses the scientific, technical and socio-economic information important to comprehending the science of climate and climate change, potential impacts of climate change and options for adaptation and mitigation. This assessment is provided via Assessment Reports, Special Reports, Methodology Reports and Technical Papers, and is used to inform the work of the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC is the political multi-lateral process by which countries agree on measures to counteract the negative consequences of climate change through placing limits on greenhouse gas emissions, and through adapting to the unavoidable consequences of a changing climate.

[Table 1 about here]

The UNFCCC definition of climate only encompasses climate change attributed to human activities. In contrast, the IPCC defines climate change as any "change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity" (IPCC, 2007a, p. 30). In other words, in IPCC usage there is no pre-judgement whether a given change in climate was caused by human activities or may be a natural phenomenon. Rather, scientific research must be used to answer such questions. This chapter uses the broader climate change definition of IPCC, but focuses on anthropogenic climate change.

The IPCC has established three working groups that prepare reports on specific thematic areas. The IPCC Working Group I assesses available scientific information on the climate system and climate change. The IPCC Working Group II assesses the impacts of climate change and the vulnerability of natural and socio-economic systems to climate change, and options and ability to adapt to such changes. The IPCC Working Group III assesses the technical and economic feasibility of strategies to reduce greenhouse gas emissions and hence reducing the rate and magnitude of future changes in climate. Reductions in greenhouse gas emissions are usually referred to as "mitigation", while efforts to adapt to changes in climate are referred to as "adaptation". Each working group is co-chaired by one scientist from a developing country and another from a developed country. IPCC reports are prepared by teams of scientific authors, and undergo a two-stage peer-reviewed process (first by experts and then by both experts and governments). This peer-review process is followed by an adoption and approval process in which a plenary with IPCC members accept the final reports and agree on the wording of the report's executive summary (know as "Summary for Policymakers"). None of the authors who prepare the assessments are paid by the IPCC for their work, and authors are drawn from the current global and active scientific community (IPCC, 2004). These features of the IPCC work provide robust support for the scientific integrity, transparency and reliability of its assessments. Figure 1 shows the worldwide web search volume for "climate change vs. global warming" on Google Trends, and serves as a crude indicator of the impact of IPCC work on people's awareness of these issues. As can be seen, the spikes in the graph in 2007 coincide with the release of the IPCC reports and the announcement of the Nobel Peace Prize award for the IPCC and Al Gore for their efforts to build up and disseminate greater knowledge about anthropogenic climate change.

[Figure 1 about here]

The IPCC (IPCC, 2007a; 2007b) has provided international peer-reviewed scientific evidence for (amongst other findings) the following:[2]

[2] Interestingly enough, some commentators argue that because not all scientists agree or fully endorse these evidences they should be ignored. Would they give the same advice for say a cancer patient who is testing a new treatment for her/his disease? Should the patient wait until a full scientific consensus is reached about the new treatment before undertaking it? Likewise, should we wait for a similar consensus before acting to solve the environmental problems we face? As the reader will soon see, the scientific evidence for climate change is more compiling and consensual than the evidences for most of the medical treatments we readily accept and employ.

- There is unequivocal evidence of the warming of the climate system, including increases in global average air and ocean temperatures, pervasive melting of snow and ice, and rising global average sea level
- Global mean temperature has risen approximately 0.76º Celsius since 1850 and continues to rise from decade to decade
- Changes in arctic temperatures and sea ice, widespread changes in precipitation amounts, ocean salinity and wind patterns are long-term changes already observed due to climate change; recent warming has already affected many natural systems on every continent and most oceans
- Concentrations of greenhouse gases (carbon dioxide, methane and nitrous oxide) have increased strikingly since 1750 as a result of human activities (i.e., from deforestation, land use change, burning fossil fuels)
- Human activities that increase the concentration of greenhouse gases in the atmosphere are largely responsible for the observed increase in temperature over the past 50 years
- Increasing emissions will further enhance the greenhouse effect and result in an additional warming of the Earth's surface over the 21st century that will very likely be greater than the warming observed over the 20th century
- Climate models predict a increase of the global mean temperature between 1.1 to 6.4ºC over the next 100 years, depending on future greenhouse gas emissions
- Extreme weather events including droughts, heavy precipitation, heat waves and the intensity of tropical cyclones have also been observed and in many places are expected to become more frequent and/or intense as the climate warms
- Sea level is projected to rise by about 0.5m by 2100, and would continue to rise inexorably for many centuries in a warmer world (more recent studies suggest that this rise could occur even faster)
- The projected changes in climate will result in many negative impacts on ecological systems and socio-economic sectors, including e.g. food supply, water resources, and human health
- The impacts of climate change will be felt in all countries, but developing countries and some key ecosystems are generally most vulnerable

This evidence is very serious. They show that the planet is warming up, that our natural weather patterns are changing, that human activities are largely responsible for these changes, and that projected future changes are likely to have significant impacts on the most vulnerable people. Scientists are now very confident that the observed changes in climate are not just a natural weather cycle (Collins, Colman, Haywood, Manning, & Mote, 2007). Indeed, IPCC revised its conclusion that most of the warming observed since the mid-20th century is attributable to humans from *likely* (more than 66 percent probable) in the 2001 report to *very likely* (more than 90 percent probable) in the 2007 report (Collins et al., 2007). More worrying still is the fact that although very accurate, the 2007 IPCC report has been seen as too cautious as new scientific data is reported on unexpectedly rapid changes, such as the dramatic further reduction in Artic sea ice during 2007 and 2008 (Kintisch, 2009).

Evidence thus supports the claim that global warming and climate change are anthropogenic. Ecological systems in many regions of the world are now more controlled by anthropogenic rather than by natural forces. The Italian geologist Stoppani created the term "anthropozoic era" in 1873 to refer to humans as a new

factor (a new geological force) in nature (as cited in Clark, 1988, Footnote 1). More recently, Crutzen and Stoermer (2000) coined the term "anthropocene" to refer to this same idea of humans as a major geological force, and to characterise the current geological epoch of a global-level impact of human activities on geology and ecology.

Given the key role of human behaviour in the current environmental issues, psychology and in particular environmental psychology can boldly lead initiatives that address these issues, as several publications in the area have already made clear (see, e.g., Gifford, 2008a; Oskamp, 2000; Schmuck & Schultz, 2002; Schmuck & Vlek, 2003; Vlek & Steg, 2007). In the next section, I will explore the psychological barriers or constraints that affect the ability of people to think and act about global warming and climate change.

Environmental numbness and psychological characteristics of climate change

Gifford (2008a) has recently expanded his concept of "environmental numbness." He argues that "most people, most of the time, simply are not thinking at all about climate change. Instead, they are (understandably) thinking about their work, their friends and family, or the big game." (p. 277). Environmental numbness thus implies that people can be intentionally thinking about climate change but choose not too. However, there are also unintentional psychological mechanisms that work as barriers or constraints preventing people from becoming aware of climate change and from acting on this awareness. These psychological characteristics were addressed in one of the first psychological papers dealing with global environmental changes published by Pawlik (1991). In a concise but important work, Pawlik proposed five "psychologically inadvertent characteristics" related to climate change. These characteristics influence people's evaluations of climate change, and can help us to understand the human failure to become aware of global environmental changes. These inadvertent characteristics of climate change are reviewed and expanded next.

1. Psychophysiological barriers

The first psychologically inadvertent characteristic of climate change is humans' psychophysiological barrier to perceiving the physical signs of these climate changes. Pawlik (1991) referred to this as the 'low signal-to-noise ratio of global change'. As presented above, evidence shows that the global mean temperature has risen approximately 0.76ºC and is going to increase between 1.1 to 6.4ºC over the next 100 years. However, the variation in temperatures that humans normally experience from summer to winter, or even variations in temperatures during a single day, are typically higher than the evident warming due to climate change. The physical 'signals' of changes in temperature due to climate change are thus weak in value if compared to the strong 'noise' of changes in temperature due to daily, seasonal and regional variations (Pawlik, 1991). Because of the weak physical signals of climate change, sensory and memory mechanisms are unable to discern them as they are below the common thresholds of discernability. Its weak physical signals make climate change harder to notice than other environmental problems. It is easier to notice deforestation, air and water pollution than small variations in temperature.

Pawlik does not assume that global changes in temperature are not important, just that people tend not to notice them. Indeed, it would be incorrect to assume that because the magnitude of climate change appears small compared with day-to-day variability, it is irrelevant. Global annual average temperatures normally only vary by a few

tenths of a degree from one year to the next. Hence an increase in several degrees in global average temperature is a significant change on geological proportions. In addition, small changes in average temperature can lead to a disproportionate increase in extremes, for example heat waves. Apart from temperature, changes in average rainfall of several tens of percent are projected in many already dry regions of the globe, with attendant increase in drought risk. Combining all these changes, the physical signals will therefore soon become very noticeable as the consequences of changes in the climate increase in ecosystems and for human activities such as agriculture, coastal storms and public health. If we were to wait for rapid and catastrophic changes before taking global action the situation would get worse than already is now.

2. Temporal barriers

Another psychologically inadvertent characteristic refers to temporal barriers related to awareness of climate change. There is a great time lapse between human actions and their influence on environmental change. As pointed by Reisinger (2003) for the example of ozone depletion, "there is a lag of about 30 years from the first discovery of a global environmental risk to the period of maximum environmental damage, and a lag of more than 60 years from the beginning of concerted international action until the environmental perturbation will have been reduced to levels prior to anthropogenic interference" (p. 111). This means that in the case of ozone depletion there is a time lapse of about one hundred years from discovery of the potential environmental problem to its eventual resolution.

This temporal barrier was referred to by Pawlik (1991) as the 'extreme masking and delay of cause-effect gradients'. The great temporal delay between human actions and their perceptible influence on environmental systems (i.e., cause-effect gradient) means that the consequences of human actions go beyond a single generation. The environmental problems we are facing now are a result of maladaptive human behaviour of previous generations, and our current maladaptive behaviours will have consequences for our generation as well as for several generations to come. Indeed, climate scientists agree that the consequences of climate change will be felt by plants, animals and humans for at least the next thousand years (Collins et al., 2007). Our current actions will thus influence how the world will develop over centuries to come. Conversely, it means that actions to reduce risks from climate change will present costs to the current generation but the main benefits of such actions would be accrued only by future generations.

This second characteristic of climate change can be expanded to include another temporal barrier that is more related to individuals' temporal orientations rather than to the phenomenon of climate change *per se*. This second temporal barrier of climate change is related to people's capacity and interest in thinking long-term. Research has shown that environmental issues entail not only a social conflict (discussed below) but also a temporal conflict (a conflict between short- and long-term interests) (Joireman, Van Lange, & Van Vugt, 2004). More specifically, research has shown that future-oriented individuals (those who are aware of and concerned about the future consequences of their actions) tend to care and act more to address environmental issues than present-oriented individuals (for a review, see Pinheiro & Corral-Verdugo, this volume). This means that individuals who care about environmental issues focus

more on public and long-term interests, rather than on their immediate needs and concerns (Milfont & Gouveia, 2006).

Extending this line of research on the impact of individuals' time orientation on environmental awareness, we recently showed that attitudes toward climate change responsibility predict differential support for political parties *only* for people who have children (Milfont, Harré, Sibley, & Duckitt, 2008). Attitudes toward climate change responsibility predicted increased support for a center-left party in New Zealand (The Labour Party) and decreased support for a center-right party (The Labour Party) but only for people with children. For people without children, such attitudes did not predict support for either of these political parties. We proposed an 'environmental generativity' account to theoretically ground this finding, based upon Erickson's (1950) theory of life-span psychological development. Erickson sees generativity as the challenge underlying the seventh stage of human development, and is manifest as a desire to leave a social legacy and provide positive guidance for others. Following this idea, we argued that parenting may help prompt an 'environmental generativity' so that parents (compared to non-parents) feel more inclined to preserve the environment for their children. This indicates that the desire to leave a social legacy and the future orientation underlying generativity tendencies are characteristics related to climate change. This seems self-evident given that parents have a clear stake in the welfare of future generations and thus have an obvious motivation to care about the future of the planet. As a result, political parties perceived as more pro-environmentally oriented may be more likely to attract the votes of people who are concerned about climate change when they have a vested interest in preserving the environment for future generations, and particularly one's children.

There is therefore robust evidence for the role of temporal barriers as psychologically inadvertent characteristic of climate change. This is expressed in respect of the delay between current actions and their future consequences on environmental systems, as well as the impact of people's time orientation on their awareness of such issues. It has even been argued that it is difficult for humans to adopt a future-centered conceptualization of problem-solving, which is needed for addressing environmental issues, because of evolutionary characteristics of human personality (Shackelford, 2006).

3. Judgemental barriers

The third psychologically inadvertent characteristic of climate change refers to human tendency to underestimate the occurrence of low-frequency events. Pawlik refers to this as the 'psychophysics of low-probability events'. People tend to underestimate the increasing frequency of natural disasters produced by global warming and climate change, such as hurricanes and major flooding, because of their low absolute rate of occurrence (Pawlik, 1991). This tendency to minimize events with a small probability of occurrence is a cognitive bias that originates from judgmental heuristics (mental strategies or cognitive short-cuts). When making judgements under uncertainty we tend to use such heuristics for reaching subjective probabilities (Tversky & Kahneman, 1974). Judgement by availability is one of the heuristic postulated by Tversky and Kahneman (1974), and is used when "people assess the frequency of a class or the probability of an event by the ease with which instances or occurrences can be brought to mind" (p. 1127). Because instances or occurrences of global

warming and climate change (or natural disasters produced by those) cannot be easily brought to mind, its probability of occurrence is underestimated due to a cognitive bias. Uncertainty related to environmental problems not only influences risk perception but also behaviour. For example, research has shown that increasing the level of certainty (or probability of occurrence) that negative effects of resource depletion would occur increased participants' willingness to limit resource consumption (Kortenkamp & Moore, 2006).

Another related cognitive bias that functions as a psychologically inadvertent characteristic of climate change refers to more specific analyses of risk perception. Research has shown that we tend to evaluate hazards as more threatening when such hazards are perceived as unknown (Slovic, 1987). Slovic (1987) reports a study that asked participants to rate 81 hazards (e.g., DNA technology, pesticides, pollution from coal burning) on 18 risk characteristics (e.g., common, immediate, fatal, controllable). Using a factor-analytic approach to provide a spatial representation of the relationships among the hazards and the risk characteristics, two risk factors were identified: a Dread Risk factor and an Unknown Risk factor. These two risk factors have been confirmed in several other cross-cultural studies (Boholm, 1998). The Dread Risk factor (uncontrollable, global catastrophic, consequences fatal, not easily reduced) included hazards such as nuclear technology and radioactive waste. The Unknown Risk factor (not observable, unknown to those exposed and to science, effect delayed) included chemical technology hazards. While people were more afraid of hazards that are both dreaded and unknown, people wanted to reduce the current risks and wanted stricter regulation especially for hazards scoring high on the Dread Risk factor.

These two cognitive biases are related to climate change. Natural disasters caused by changes in global climate are underestimated because of their low frequency of occurrence as well as because of their familiarity. Risks from climate change (e.g., floods, sea rise) are by and large known and thus underestimated (Weber, 2006). Hence, risks from say nuclear reactor accidents (low-frequency event but unknown) are perceived as more threatening than increasing hurricanes due to climate change (low-frequency event but known).

4. Geographical and social barriers

Another psychologically inadvertent characteristic of climate change signed by Pawlik (1991) refers to the 'social distance between actors and victims of global change.' As discussed above, the environmental consequences of global warming and climate change have impacts across temporal social distances, so that future generations will have to deal with the environmental problems caused by the behaviour of our generation. But these consequences not only operate across temporal social distances; environmental impacts due to global warming and climate change are also carried across spatial social distances. Our maladaptive behaviours will have negative consequences for generations living away apart in both place and time.

Research looking at the way people evaluate environmental problems in distinct geographical places helps us to understand the social distance underlying climate change. Uzzel (2000) observed people's tendency to perceive environmental problems as more worrying when they take place at greater distances, which he calls 'environmental hyperopia.' As a result of environmental hyperopia, people are

typically more concerned about environmental problems at the global and international level than they are at the local and regional level. Several empirical studies have supported this phenomenon (see, e.g., Freury-Bahi, 2008; García-Mira, Real, & Romay, 2005). As an illustration, I re-analysed cross-cultural data of 468 participants from 59 countries (Milfont, Sibley, & Duckitt, in press). As can be seen in Figure 2, while showing significantly higher ($p < .001$, $d = .21$) feelings of responsibility for environmental problems in their community than for environmental problems worldwide, participants rated the seriousness of global warming worldwide as significantly higher ($p < .001$, $d = 1.04$) than the seriousness of global warming in their community. This supports the environmental hyperopia and shows that we tend to perceive global warming and climate change as more threatening to others than to ourselves.

[Figure 2 about here]

A similar phenomenon that has been related to environmental issues is optimistic bias (Hatfield & Job, 2001; Pahl, Harris, Todd, & Rutter, 2005; Uzzell, 2000). Weinstein (1980) was the first to demonstrate optimistic bias by showing that people tend to believe their chances of experiencing positive events to be higher than that of other people, and their chances of experiencing negative events to be lower. Some studies have investigated environment-related optimistic bias. Hatfield and Job (2001) investigated optimistic bias regarding environmental hazards. Contrary to their expectations, they found only low levels of optimistic bias regarding general environmental hazards. However, higher levels of optimistic bias were found regarding both the likelihood of hazards affecting the participant's local area, and the participant's perception of their own knowledge of suitable ecological behaviours to reduce environmental problems produced by the hazards. More recently, Pahl et al. (2005) conducted two studies investigating whether optimistic bias exists in relation to environmental risks and also whether this bias can be used to predict self-reported ecological behaviour. Although Pahl et al.'s (2005) findings indicate that optimistic bias is relevant to environmental issues, no direct association was found between optimistic bias for environmental risks and ecological behaviour.

Conceptually integrating environmental hyperopia with optimistic biases, Freury-Bahi (2008) investigated environmental risk perception for four distinct targets (i.e., risk to oneself, inhabitants of the town, inhabitants of the country, and humanity) and three categories of hazards (including climate change). In line with environmental hyperopia and optimistic biases, he observed that participants' perceived risk of climate change increased as both the size of local area and the number of people under consideration also increased. Climate change was thus rated as a greater risk for humanity than for inhabitants of the country, inhabitants of the town, and for oneself (i.e., humanity > country > town > oneself). These findings support the notion of a psychologically inadvertent characteristic of climate change related to the actors-victims social distance: even if people are convinced climate change is a major issue facing the planet, they do not feel climate change will affect them much.

5. Social dilemma barriers

The final psychologically inadvertent characteristic of climate change signed by Pawlik (1991) refers to the 'low subjective cost-effectiveness of environment-conserving behaviour.' This characteristic stands for the practical understanding that

many (if not most) of one's detrimental acts to the environment are more cost-effective for oneself than acts that are less detrimental. Put in other words, from an individualistic point of view pro-environmental behaviours (e.g., walking, biking or taking public transport to work) are often more costly in terms of personal comfort and convenience than anti-environmental behaviours (e.g., driving to work).

This low subjective cost-effectiveness of pro-environmental behaviours can be understood through the conceptualisation of social dilemmas. When in a social dilemma situation we are caught between two competing alternatives: to act serving our own interests or to act serving the needs of the group we belong to or wider society. Hardin (1968) was the first to describe the notion of social dilemma in his paper *The Tragedy of the Commons* dealing with the risks of overexploitation of natural resources as a result of the conflict between individual interests and the common good. A prototypical example of the tragedy of commons is the situation in which fishermen have little incentive to act alone to preserve the shared fish stocks and as a result suffer collectively from overfishing. Environmental issues are understood as social dilemmas because they represent a conflict between the collective interest of society and the individual interests of its members (Milfont & Gouveia, 2006; Osbaldiston & Sheldon, 2002; Van Vugt, 2001; Van Vugt & Samuelson, 1999). This conflict between private and public interests comprises the social dimension of the dilemmas. But a temporal dimension (see discussion above) has also been acknowledged as another conflict underlying social dilemmas (Joireman, 2005; Joireman et al., 2004; Messick & Brewer, 1983). Hence, environmental issues are social dilemmas with a conflict between short-term individual interests and long-term collective interests (Milfont & Gouveia, 2006).

There is also a distinction in the literature of two types of social dilemmas: The resource dilemma and the public goods dilemma (Van Vugt, 1998). The resource dilemmas are situations that require individuals' cooperation to preserve a valuable resource (e.g., rain forest), while public good dilemmas are situations that require individuals' cooperation to create a valuable good (e.g., creation of a community centre for edible gardening). Although specific environmental issues might encompass mainly a resource dilemma, broader environmental problems such climate change clearly involves both resource dilemmas and public good dilemmas. In fact, Gifford (2008b) have developed a theoretical model that can be applied to both types of social dilemmas. The model integrates influences on and outcomes of social dilemmas with relevance to environmental issues, including climate change (Gifford, 2008a). According to the model, five categories of influence (i.e., geophysical, governance, interpersonal, decision-maker and dilemma-awareness influences) have important consequences for the outcomes of social dilemmas. The influenced outcomes are: outcomes for the decision-maker (e.g., emotional, financial and social satisfaction) and outcomes for the environment (e.g., public good is completed or not; resource depleted or sustained).

Overall, the imbalance between private good and public good comes from the fact that environmental issues are usually the result of a large number of individual destructive acts. Hence, *one* individual chosing not to commit such an act has a very small influence on the overall outcome, but for the specific individual concerned, the choice between committing or not committing such an act can be significant. Individuals will benefit more in a social dilemma if he or she defects, but the group as a whole is

worse off if everyone defects than if everyone cooperates. As a result, individualistic orientations tend to produce negative outcomes in social dilemmas. As research has shown, individuals who place higher priorities in individualistic, self-centred value orientations tend to be less concern about environmental issues and to act accordingly (Coelho, Gouveia, & Milfont, 2006; Milfont, Sibley et al., in press; Schultz et al., 2005). For example, we found that self-enhancement values were negative predictors of ecological behaviour (while altruistic values were positive predictors) in samples from Brazil, New Zealand and South Africa (Milfont, Duckitt, & Wagner, in press).

Construal levels and psychological distance: Towards an integrative approach to understand climate change as a psychologically distant situation

Climate change is an environmental risk characterized by weak physical signals, high uncertainty, time-delayed consequences, low subjective cost-effectiveness, and great geographical and social distance. These characteristics were outlined in Pawlik (1991) and expanded upon above. These climate change characteristics are implicitly discussed by other scholars (e.g., Dunlap & Jones, 2002; Gattig & Hendrickx, 2007), and there are also other individual and social perceived barriers to engaging with climate change that are not discussed here (Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007). However, no previous attempt has been made to integrate the several barriers related to climate change. I use the Construal Level Theory (Liberman & Trope, 1998; Trope & Liberman, 2003) to briefly outline a novel integrative approach for understanding climate change (and other environmental risks) as a psychologically distant situation.

According to Construal Level Theory (CLT), temporal distance influences people's responses to future events: events in the distant future are viewed in more abstract and superordinate terms (high-level construals), while events in the near future are viewed in more concrete and detailed terms (low-level construals). The theory has later been expanded to include not only temporal distance but also other dimensions of psychological distance (Trope, Liberman, & Wakslak, 2007). An event is more psychologically distant as it takes place farther into the future (temporal distance), as it occurs in more remote locations (spatial distance), as it is less likely to occur (hypotheticality), and as it happens to people less like oneself (social distance). The basic premise of CLT is that the more psychologically distant an event is (i.e., the greater the temporal, spatial, hypothetical, or social distance from an event), the more distant it appears and the more it will be represented at higher levels of abstraction. Therefore, CLT posits that similar mental construal processes underlie psychological distance dimensions, and that these construal processes guide the way people predict, evaluate, and plan psychologically near and distant situations (Liberman & Trope, 2008). Indeed, several studies testing CLT hypotheses have shown that dimensions of psychological distance are (i) interrelated, (ii) affect and are affected by the level of construal (i.e., people think more abstractly about distant than about near situations, and more abstract construals also lead people to think of more distant situations), and (iii) have similar effects on prediction, evaluation, and action (for reviews, see Liberman & Trope, 2008; Trope et al., 2007).

All climate change barriers discussed above involve some form of psychological distance. Climate change has weak physical signals and uncertain outcomes so is perceived to be less likely to occur (hypotheticality), takes place farther into the future (temporal distance), and is perceived to be more likely to occur in more remote

locations (spatial distance) and to people less like oneself (social distance). Thus, psychophysiological and judgemental barriers are related to hypotheticality, and temporal, geographical and social dilemma barriers are linked to temporal, spatial and social distances, respectively. The links between barriers and psychological distance indicates that climate change can be regarded as a psychologically distant situation. And because climate change is a psychologically distant situation, CLT would predict that the way people mentally represent it is by abstract representations, or high-level construals. High-level construals consists of general, structured, parsimonious, superordinate, and essential features of a situation (Trope & Liberman, 2003). This means that climate change is likely to be represented in terms of a few abstract features that convey its perceived essence rather than in terms of more concrete and incidental details.

A CLT account of climate change has important implications for understanding the way people evaluate environmental risks in general and also on action plans related to these risks. Take the role of feasibility and desirability considerations of climate change, for example. Whilst desirability refers to the value of an action's end state (superordinate, *why* aspects of an action), feasibility refers to the ease or difficulty of reaching the end state (subordinate, *how* aspects of an action) (Liberman & Trope, 1998). So, desirability concerns the value (why) of overcoming climate change, whereas feasibility concerns the amount of effort we have to invest (how) to tackle climate change. Although climate change involves both desirability (moral principals and ideals) and feasibility (difficulty, cost, and situational pressures) considerations, moral principles are more likely to guide decisions involving high-level construals and psychologically distant situations. Therefore, moral principals and ideals should be key variables guiding people's decisions to tackle climate change. This prediction might explain the known role of values in predicting environmental attitudes and behaviours (see discussion below). Using CLT as a framework for understanding the construal of climate change and other environmental risks seems a fertile endeavour for theoretical and empirical development in the area.

Psychological research for tackling climate change

As it is clear from the discussion and research examples discussed earlier, psychological research is important for understanding and overcoming barriers related to climate change. This section focuses on research agendas to help this process. Important actions for addressing climate change have been proposed and discussed by other commentators (Crompton, 2008; Gifford, 2008a). Here I will concentrate my analyses on four interrelated areas for further psychological research that deserve special attention. An effort is made to highlight the importance of the integrative approach discussed above in the research agendas.

Risk perception. Climate change is an example of "hidden hazards," or risks that are unnoticed or unattended until they reach disaster proportions, despite their serious consequences for society (Kasperson & Kasperson, 1991). In line with this, public opinion polls and academic studies examining the relative importance of several environmental problems have shown that global warming and climate change are not salient issues in people's minds (e.g., Bord, Fisher, & O'Connor, 1998; Leiserowitz, 2004). This hidden feature of climate change is further exacerbated by the psychophysiological barriers of climate change discussed above. Future studies should investigate the specific mechanisms by which people perceive climate change

as a risk or not. Considering the fact that climate change is a psychologically distant situation, research should focus on the interrelationship of all dimensions of psychological distance in affecting people's perception of climate change as a risk (cf. Gattig & Hendrickx, 2007). An inclusive approach that takes into account all these factors will provide a way to understand how individuals consider the potential climate outcomes of their past and current behaviours for themselves and others (away in place and time), and also the extent to which they are influenced by these potential future outcomes.

Risk communication. Communication seems the ideal tool for making climate change an "unhidden" risk. Pawlik (1991) argues that communication can address many of the barriers outlined above. Likewise, Gifford (2008a) argues that to challenge environmental numbness we need, among other things, "to get as many people around the world as possible actively thinking about climate change" (p. 277). These positions seem to support the knowledge-deficit model (cf. Kellstedt, Zahran, & Vedlitz, 2008), according to which providing information about global warming and climate change would increase public concern about these issues. Communication is thus expected to create awareness and willingness to act even considering the uncertain, gradual, long-term signals of climate change. However, the effect of communication and information on increased concern is not that simple. For example, some researchers were unable to find a clear effect of perceived information about global warming and climate change on concerns and intention to act (Heath & Gifford, 2006; Kellstedt et al., 2008). Further psychological research is therefore needed to examine whether increased information about climate change can indeed lead to higher concern and proper actions. Three general areas of research could be explored.

(1) It has been recently suggested that climate communication should use a combination of top-down (regulatory approaches that forces green behaviour) and bottom-up (fostering voluntary action to reduce emissions) approaches to both facilitate public acceptance of regulations related to climate change and to stimulate grass-roots action (Ockwell, Whitmarsh, & O'Neill, 2009). This combination of approaches for climate communication seems reasonable. It seems that we cannot rely only on individuals to take collective action; we have to make collective action normative and subject to social sanctions through policies and laws. However, the psychological reasons for combining top-down and bottom-up approaches have not been spelled out nor tested.

(2) Environmental risks are more likely to be accepted when they are presented as gains rather than as losses (Gattig & Hendrickx, 2007). This suggests that framing climate communications in a way that it is perceived as an increase of an existing risk may prove more effective. Another possibility is to tailor climate change messages to the specific processes underlying behaviour change, and to frame these messages as a function of the intrinsic versus the extrinsic costs or benefits of the behaviour (Pelletier & Sharp, 2008). It is a question for future research whether these tailoring and framing strategies are more effective in climate communication.

(3) Besides addressing broad climate communication approaches and framings, future research should also explore specific issues related to communicating uncertainty. A recent study has shown that the way the IPCC reports communicate uncertainty (using a set of probability terms accompanied by global interpretational guidelines) leads to imprecision and errors in

communication related to climate change information (Budescu, Broomell, & Por, 2009). Future studies could address whether changes in the way IPCC reports communicate uncertainty can lead to higher risk awareness and actions.

(4) Future research should also explore the implications of the high-level construals of climate change in risk communication. As discussed above, climate change is likely to be represented in terms of a few abstract features that convey its perceived essence. Climate change communication should thus take these features into account.

Intertemporal and interpersonal issues. Climate change comprises a conflict between short-term individual interests and long-term collective interests. Current destructive behaviours will have negative consequences for generations living away apart in both place and time. Moreover, while actions to reduce risks from climate change represent costs to the current generation, their resulting benefits would be accrued only by future generations. Climate change therefore encompasses intertemporal and interpersonal issues. Future research should further examined the link between temporal and social distances in the climate change dilemma (cf. Joireman, 2005; Milfont & Gouveia, 2006; Milfont et al., 2008). One possibility would be to link the social dilemma framework with the CLT account of climate change. CLT predicts that more abstract construals should be applied to other people and out-group while more concrete construals should be applied to self and in-group (Liberman & Trope, 2008). In line with this, CLT may be expanded into the social dilemma framework by considering the influence of both temporal and social distance on climate change construals. One might postulated that events in the distant future are viewed in more abstract and selfless terms (i.e., "a tax on gas will reduce fuel consumption and pollution"), while events in the near future are viewed in more concrete and selfish terms (i.e., "a tax on gas will cost me more money when I fill up my gas tank"). Given that climate change is a distant future event, the information and evaluative implications of high-level construals and cooperative orientations, compared to low-level construals and competitive orientations, should have more impact on the way people mentally represent climate issues. Empirical studies could address this possibility. The link between intertemporal and interpersonal issues is also important because social influence can be enhanced by future thinking. Research has shown that reflecting on the future, or thinking about future consequences, increases persuasive attempts by influencing choices in the present (Sherman, Crawford, & McConnell, 2004).

Dominant values. The areas of research discussed above are important for addressing climate change. Enhancing risk perception and communication could increase awareness, and understanding the link between intertemporal and interpersonal issues can facilitate the promotion of personal and collective actions for overcoming environmental issues. However, these research areas do not question nor address the implicit causes of climate change or other environmental issues. Most (if not all) current environmental problems are a result of the assumption that the ever-increasing economic growth should be the main drive for development. This growth paradigm and its underlying values, such as individualistic, materialistic and consumeristic values, influence the way we relate to nature.[3] Commentators and researchers have

[3] Annie Leonard's movie *The Story of Stuff* provides an interesting portrait of these underlying values.

argued that these values have to be challenged if we are to successfully address environmental issues (Brown & Cameron, 2000; Crompton, 2008; Flavin & Engelman, 2009). No action will be completely effective if the dominant values that lead to the current environmental problems are not challenged. This is because any agreement or action built on the assumptions of ever-increasing economic growth is doomed to failure (Flavin & Engelman, 2009). A core role of psychological research should thus be to identify ways and means by which the underlying growth paradigm, and its underlying values, can be challenged without leading to an immediate blockage by the people whose growth would be halted. Furthermore, values constitute moral principals and ideals that, according to CLT and the approach described above, are more likely to guide decisions for situations with high psychological distance, like climate change, because they represent desirability concerns (cf. Liberman & Trope, 1998). Values are thus crucial psychological variables for challenging the state of affairs for the way we relate to nature. Indeed, research has shown the predictive power of values in explaining people's environmental attitudes and behaviours (e.g., Milfont, Duckitt et al., in press; Milfont & Gouveia, 2006; Milfont, Sibley et al., in press)

The challenge of change

The focus of this chapter has so far been on evidence, facts and research agendas. The evidence reviewed is worrying and can be overwhelming. There is the possibility that we might end up in a state of inertia due to what the New Zealand journalist Margie Thompson calls eco-anxiety: feelings of guilt with overtones of fear followed by feelings of being overwhelmed by all the changes you know you should make to your lifestyle. However, it is important to highlight that apart from the mounting scientific evidence about the impact of human behaviour on the global climate, there is also rapidly increasing evidence about options to reduce greenhouse gas emissions and thus reduce the rate and magnitude of climate change (see, e.g., IPCC, 2007a). This means that hope, awareness and action should overcome despair, denial and inertia, and the focus should be on ways we can ameliorate the impact of climate change in our lives.

Although climate change cannot be prevented entirely, its rate and consequences can be downgraded by global and local reductions of greenhouse gas emissions (Hare, 2009). In virtually every sector of human activities (energy, industry, buildings, agriculture, forestry, and waste management) there exists a significant potential to reduce emissions through new technologies, use of existing more efficient technologies, and changes in behaviour. The overall economic costs of such changes are estimated to be small, reducing the global average growth rate of GDP by less than about 0.1 percentage points (Stern & Taylor, 2007), but they would require significant policy changes including placing a cost on the emission of greenhouse gases.

Because climate change is caused by human behaviour, its solution lies in changing human behaviour. Actions to reduce emissions, including use of clean-energy technologies, policy changes, domestic regulations and international treaties, will be a result of community and individual decisions. Individual actions have thus a meaningful impact in addressing climate change. Research supports this by showing that individuals must believe that even small personal actions can make a meaningful difference before they decide to act against climate change (Heath & Gifford, 2006).

Governmental and non-governmental agencies have also indicated the need to enhance the power of small individual actions (Crompton, 2008; Ministry for the Environment, 2007). For instance, the Ministry for the Environment (2007) in New Zealand recognises that the difference in addressing climate change will be made by the small steps taken by individuals (supported by the bigger steps of governments and businesses).

However, such changes generate significant debate and opposition from vested interests, since they would inevitably make some activities less profitable and others more so. As a result, community action is also necessary for achieving widespread changes. Communities should be encouraged to share their experiences and learn from each other. For example, the movie *The Power of Community: How Cuba Survived Peak Oil* shows how Cubans developed community initiatives and creative strategies to overcome the collapse of their formal economy. We have much to learn from their experiences and resilience strategies. Specific resilience strategies for climate change have also been discussed (Brouwer et al., 2007; Dodman, Ayers, & Huq, 2009). Therefore, psychological research should also contribute for enhancing community and individual actions.

Conclusion

This chapter dealt with the issues of global warming and climate change. The evidence and research summarized in this chapter indicate a number of important conclusions about the role of psychological research aimed to address these major environmental problems we are facing. First, evidence was shown demonstrating that these issues are happening and that they will have negative impacts on our lives. Second, five psychologically inadvertent barriers were presented that can help to understand why most people are not acting to solve these issues. Third, construal level theory was used to provide an integrative approach for understanding climate change as a psychologically distant situation. Fourth, research agendas were outlined to guide future psychological studies aiming to tackle climate change. Finally, considerations of positive actions for tackling climate change were briefly discussed.

Before concluding, I would like to point out that we tend to use broader and (at some degree) contestable concepts, such as ‘climate change’, ‘global warming’ and even ‘sustainability’, that are regrettably often used for political rhetoric rather than for political and social action. However, what is really at stake is environmental degradation. Even if the reader does not agree with such terminologies, remember that the underlying concern encompassing these concepts is the degradation of the environment. And now there is compelling evidence that human behaviour has been producing unprecedented environmental problems (e.g., Millennium Ecosystem Assessment, 2005).

I am grateful for this opportunity to discuss psychological aspects of environmental issues alongside distinguished colleagues in the field. I hope that this chapter, along with the others, will contribute to enhancing psychological theory and research for ameliorating the environmental challenges we face. We need to be aware (and make other people aware) of the negative impacts of our behaviours in the environment. And we need to lead by example. Our actions to reduce the effects of global warming and climate change will certainly encourage others to do the same. I hope the reader can join us in tackling these issues.

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Table 1. Brief summary of important historical events and initiatives related to climate change and global warming

Year	Event/Initiative
1859	John Tyndall, a UK scientist, discovers that greenhouse gases keep the Earth warmer than it would be otherwise
1896	Svante Arrhenius, a Swedish chemist, was the first to postulate that increasing carbon dioxide concentrations in the atmosphere could raise global temperatures
1979	First World Climate Conference organized by the World Meteorological Organization
1985	The Vienna Convention for the Protection of the Ozone Layer was signed
1987	The Montreal Protocol on Substances that Deplete the Ozone Layer was signed
1987	The International Geosphere-Biosphere Programme was established
1988	The establishment of the Intergovernmental Panel on Climate Change (IPCC)
1988	James Hansen, an American scientist, alerted a U.S. Senate Committee that rise in temperature was a result of the greenhouse effect
1990	The IPCC First Assessment Report was released
1992	The United Nations Framework Convention on Climate Change (UNFCCC) was signed by 154 nations during the Earth Summit in Rio de Janeiro.
1995	The IPCC Second Assessment Report was released
1996	The International Human Dimension Programme on Global Environmental Change was established
1997	The Kyoto Protocol was agreed under the UNFCCC
2001	The IPCC Third Assessment Report was released
2005	The Kyoto Protocol came into effect
2007	The IPCC Fourth Assessment Report was released
2008	Kyoto Protocol First Commitment Period started (from 1/1/2008 to 31/12/2009)
2009	University of Copenhagen Congress on Climate Change
2009	Discussions for further climate change actions are being negotiated under the UNFCCC and Kyoto Protocol

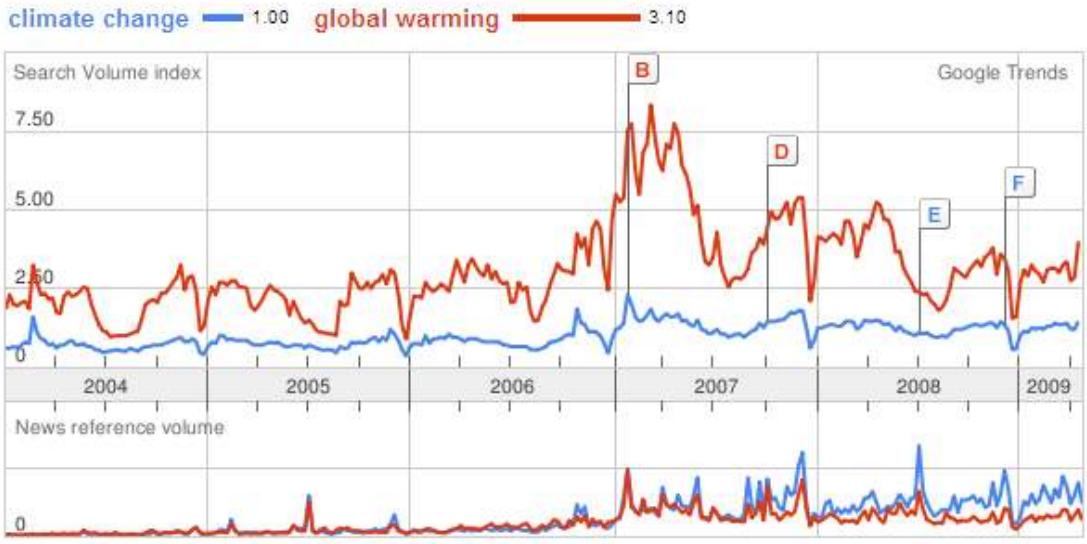

Figure 1. Worldwide web search volume for climate change vs. global warming

Note. This Google Trends data is scaled based on the average search traffic of the terms from January 2004 to April 2009. The label letters in the graph refer to automatically selected Google News stories (not shown) written about the search terms. The numbers next to the search terms correspond to their total average traffic in the time frame. The first term has a fixed value of 1.0; the number for the second term (3.10) means that global warming has about 3 times more traffic in the time frame than climate change. There is an interesting preference trend in the use of the search terms by the top 10 regions. Although the list of regions is similar, we can see the prevalence of commonwealth/English-speaking regions using the more neutrally-charged term "climate change" (i.e., Australia, New Zealand, South Africa, United Kingdom, Canada, Ireland, Singapore, India, United States, Switzerland), whereas the more emotionally-charged term "global warming" tend to be the preferred term in Asian regions (i.e., Indonesia, Philippines, India, South Africa, Australia, New Zealand, Singapore, United States, Canada, United Kingdom).

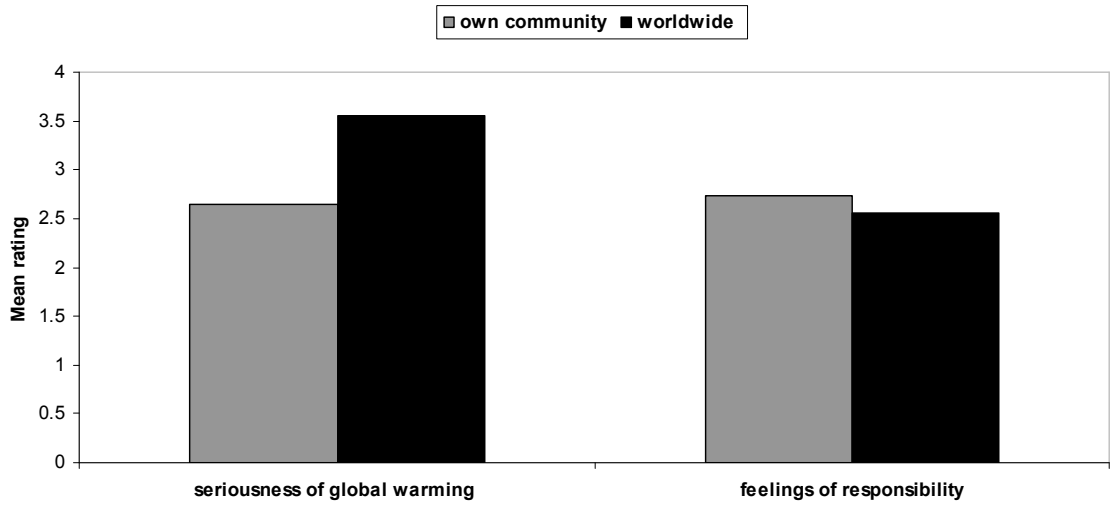

Figure 2. Environmental hyperopia in a cross-cultural sample (source Milfont, Sibley & Duckitt, in press)